

Health monitoring garment

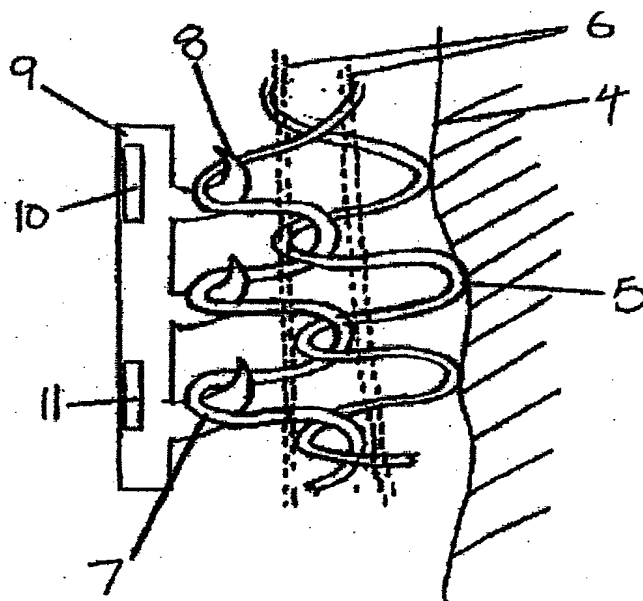
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Abstract of GB2350193

A health monitoring garment which employs a means of conducting electricity from the surface of the skin, through the fibres of a fabric to another fabric, which is removably attached to it and contains a microprocessor, telemetry and a power source to monitor and transmit ECG data of a person wearing the clothing, as illustrated in Figure 2. Removability enables the garment to be washed and the electronics to be kept separate from the washing and tumble drying process. The same system can be used in reverse to effect cardiac pacing or defibrillation or to deliver other forms of electrically conveyed healing such as tissue repair.

FIG. 2



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(58) Field of Search

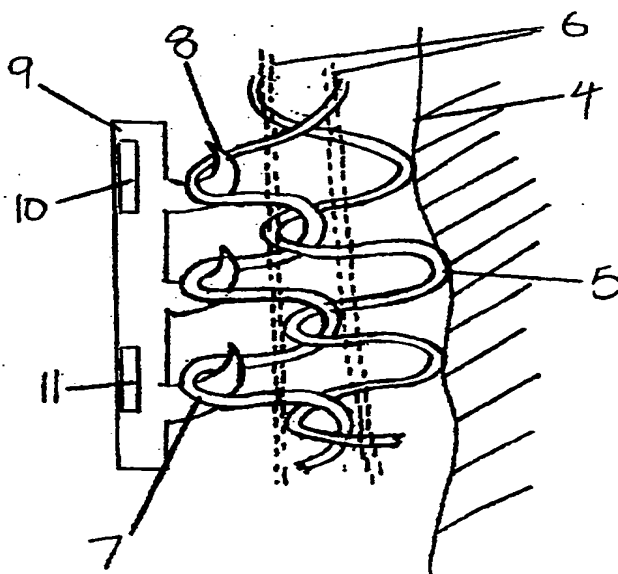
UK CL (Edition R) A5R RHEC, G1N NECG NESS
INT CL⁷ A61B 5/00 5/0408
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(54) Abstract Title

Health monitoring garment

(57) A health monitoring garment which employs a means of conducting electricity from the surface of the skin, through the fibres of a fabric to another fabric, which is removably attached to it and contains a microprocessor, telemetry and a power source to monitor and transmit ECG data of a person wearing the clothing, as illustrated in Figure 2. Removability enables the garment to be washed and the electronics to be kept separate from the washing and tumble drying process. The same system can be used in reverse to effect cardiac pacing or defibrillation or to deliver other forms of electrically conveyed healing such as tissue repair.

FIG. 2.



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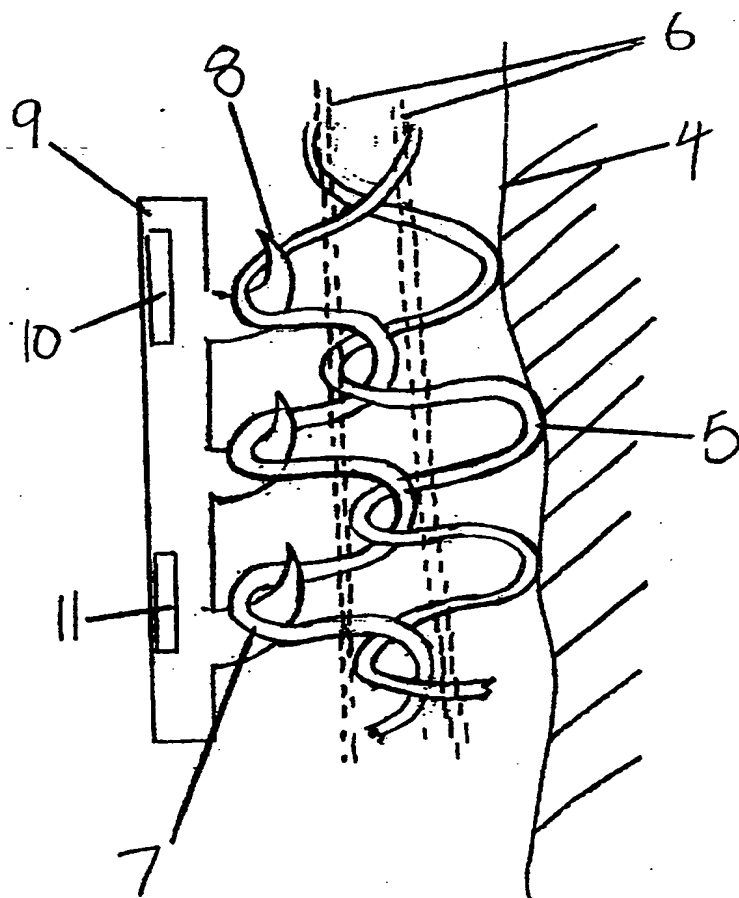
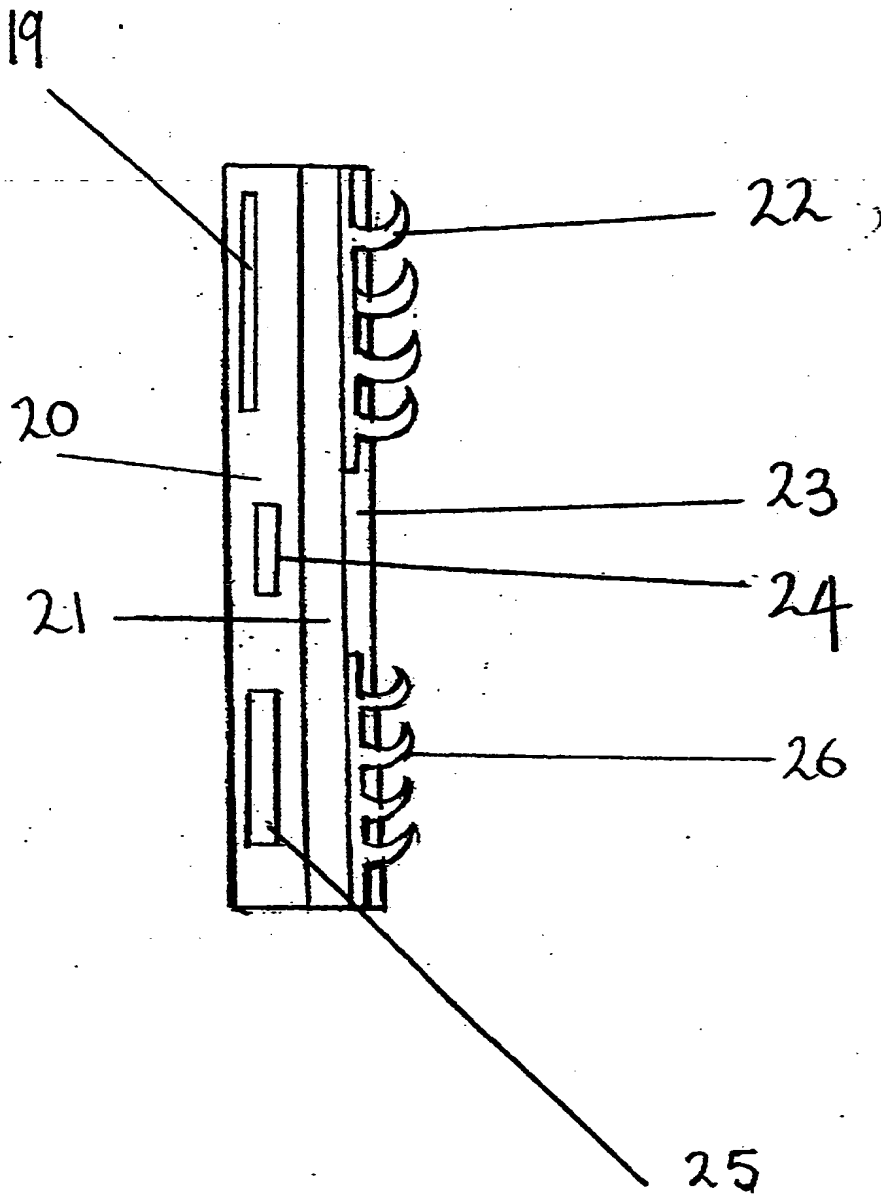
FIG. 2.

FIG. 4



conductive yarns.

According to a second aspect of the invention there is provided a sensor pad in the form of a common carrier, hereinafter referred to as the "ECG Patch" which is removably attachable to the conductive on the outside of the garment. The ECG Patch has an attachment means on its underside which may be in the form of a friction-fit mechanism similar to the hooks marketed under the brand name "Velcro". The hooks provided on the ECG Patch can be made by the same knitting or molding process as that required for traditional Velcro hooks. However in this electrical application the hooks are fabricated from a conductive material such as an electrically conductive polymer or polymers loaded with conductive particulates, for molded applications; or conductive yarns made from such materials as stainless steel, copper, polymer and carbon fibre for knitted applications.

By the interaction between the Knitted Electrodes and the conductive hooks located on the underside of the ECG Patch the electrical impulses present on the human skin are passed to a microprocessor and the wire-free transmission means located inside the ECG Patch.

The benefit of using the common carrier hook-and-loop wire-free transmission means, the ECG Patch, is that it can be used as a releasable, tear-off patch, to be removed prior to washing. This would enable the garment to be washed, tumble dried and ironed without exposing electronic package to undue water ingress, heat or friction, thereby allowing it be treated like any other normal, washable, everyday garment.

According to a third aspect of the invention there is provided in the ECG Patch sufficient electronic processing power and the appropriate algorithms to give a warning of impending severe illness such as a heart attack or asthma attack; the said warning can be in the form of a flashing light and or audible warnings emanating from the ECG Patch.

According to a fourth aspect of the invention there is provided a transformer in the ECG Patch an auxiliary electric power source, which, upon receiving a command from the microprocessor can deliver electrical shocks to the subject via the Knitted Electrodes to which it is attached. These electric shocks may be mild so as to provide a cardiac pacing function or they may be more powerful, such as 200-300 volts, to provide a defibrillating function. (Recent research has demonstrated that low power shocks can be used to restore normal heart rhythm in a fibrillating or arrhythmic patient instead of high power 2,000 to 3,0000 volt shocks.) Additional battery power could be provided by an auxiliary battery located in the ECG Patch or by wire connection to an auxiliary battery located somewhere on the subject such as in a pocket.

According to a fifth aspect of the invention there is provided in the ECG Patch a wire-free transmission and receiving means such as a radio or infra red system in

a vest, or undershirt that to them appears very similar to normal apparel, with none of the discomfort, stigma or psychological burdens associated with traditional ECG or respiratory monitors. By wearing the invention - the ECG vest- continuously, particularly at night when most of the potentially fatal cardiac events are known to occur, the computer databases linked to it, either remotely by telephone or quasi remotely by the palm-top computer worn by the patient or directly by the ECG Patch's on board ASIC (the ASIC being equipped with the appropriate microprocessor and event-identifying algorithms) the invention has a variety of life-preserving opportunities to process sufficient data to forewarn patients of an imminent heart attack and if necessary deliver arrhythmia-regulating or defibrillating electric current.

Methods and systems for monitoring electrophysiological and electrorespiratory vital signs of a subject in accordance with the present invention will now be described, by way of example, with reference to the accompanying drawings in which:-

Figure 1

Figure 1 is the general embodiment of the ECG vest where 1, is the releasable common carrier, the ECG Patch patch, 2 is the patient's mobile phone and computer with which it communicates and 3, illustrates the Knitted Electrodes beneath an ECG Patch that has been removed. For the purpose of simplicity only two of several areas of conductive loops are shown. These conductive loop areas could encompass the body if required.

Figure 2

Figure 2 is a cross sectional representation to illustrate how the electrical impulses present on the surface of human skin at 4, can be passed into a knitted or woven garment configuration comprising 5, the internal conductive loops which touch the skin; 6, the foundation loops made from a non conductive yarn which hold the internal and external loops together; 7, the external conductive loops which are attached to conductive Velcro at 8. 9 is a representation of the releasable patch which contains the electronic parts including the ASIC 10, and battery 11.

Figure 3

Figure 3 is a plan of the releasable ECG patch wherein 12, is the periphery of the patch which can be of any shape or design suitable to encompass the Knitted Electrodes; 13, is the antenna which is connected to the ASIC; 14, is one of the two conductive Velcro parts; 15, is the Applied Specific Integrated Circuit, and transformer containing the electronic elements sufficient to transmit the ECG and Respiratory impedance signals; to receive commands from the nearby mobile phone or to receive internal commands generated by ASIC-on-board algorithms and to act on those commands in respect to the provision of electric shocks to the conductive Velcro. 16 is an electric socket with sufficient connections to enable the ASIC/TRANSFORMER assembly to receive auxiliary electrical power and to communicate defibrillating instructions to standard adhesive defibrillator

CLAIMS

1. A means of conducting electricity between two fabrics so that an electric current present on the surface of one fabric can be transmitted through it to the surfaces of a second fabric so as to provide, for example, a health monitoring garment whereby the one fabric placed against the skin of an animal or human subject collects an electrophysiological signal such as an ECG and passes it to another removable fabric, where the latter may contain a wireless transmitting means.

2. A means of conducting electricity as in Claim 1 where the first fabric is a knitted or woven material presenting loops of conductive yarn and the second fabric is made from an electrically conductive hook substrate such as the male part of a hook and loop fastener commonly referred to as Velcro and made from a conductive polymer so that the conductive hooks embed firmly into the raised loops of the first fabric, thereby providing the dual functionality of passing electricity from one to another and also the ability to remove one fabric from the other.

3. A means of conducting electricity as in Claim 2 where the first fabric is a knitted or woven material presenting loops of conductive yarn and the second fabric is made from another conductive material and held against the first fabric by such means as of poppers, buttons, tape or any other attachment means.

4. A means of conducting electricity as in Claim 2 wherein the electrically conductive hook substrate is elastic made, for example, by punching a latticework of hexagonal holes in the substrate.

5. A means of conducting electricity as in Claim 1 and 2 where groups of conductive yarns and groups of receptive conductive hooks are insulated from one another so that the electric current emanating from the skin of an animal or human subject can be picked up from more than one location to emulate, for example a three lead or 22 lead ECG.

6. A means of conducting electricity as in Claim 5 where conductive yarns in a knitted fabric are separated from one another by knitting the conductive yarns in separate rows on a common non-conductive base cloth.

7. A means of conducting electricity as in Claim 6 where the conductive loops of a knitted fabric are presented as separate islands of raised loops, which would appear to be spots or any other design as can be achieved, for example, with a variable sinker height circular knitting machine.

8. A means of conducting electricity as in Claim 2 where several hook substrates are presented in groups, such as spots or co-inside, for example, with the spots described in Claim 6, wherein the hook-spots are insulated from one another by mounting them in a non-conductive substrate such as rubber or plastic.

9. A means of conducting electricity as in Claim 1 to Claim 8 where the conductive hooks, or each group of conductive hooks are attached to a microprocessor and wireless signal

Amendments to the claims have been filed as follows

CLAIMS

1. A means of conducting electrophysiological energy from the skin-surface of a human or animal subject to a computing and transmissions means whereby the energy can be conducted by an otherwise normal every-day garment by the inclusion of electro-conductive yarns, groups of which are electrically insulated from one another, to similarly insulated groups electro-conductive friction-fit hooks, (such as conductive polymer Velcro), of a removable patch containing the computing and transmission means so as to provide a measurement of the ECG/EKG.
2. A means of conducting electrophysiological energy as in Claim 1 where the normal every-day garment is a knitted or woven material presenting insulated groups of loops of conductive yarn wherein their isolation is achieved by securing the conductive loops in a knitted or woven foundation of non-conductive yarns, such may be achieved with variable height automatic sinker selection circular knitting machine.
3. A means of conducting electrophysiological energy as in Claim 1 and 2 where conductive yarns in a knitted fabric are presented as a group of raised loops insulated from another group one another by knitting the two, or multiple groups on separate rows of non-conductive base cloth.
4. A means of conducting electrophysiological energy as in Claims 1,2 and 3 where the conductive loops of a knitted fabric are presented as separate islands of raised loops, which would appear to be spots or any other design as can be achieved, for example, with a variable sinker height circular knitting machine.
5. A means of conducting electrophysiological energy as in Claims 1,2,3 and 4 where groups of conductive yarns and groups of receptive conductive hooks are insulated from one another so that the electric current emanating from the skin an animal or human subject can be picked up from more than one location on the skin to emulate a multi-lead EC/EKG.
6. A means of conducting electrophysiological energy as in Claims 1 to 5 wherein the raised loops are cut to increase surface area and may have a conductive liquid applied to them to increase conductivity.
7. A means of conducting electrophysiological energy as in Claim 1 wherein the removable patch contains an alternative conductive material to friction-fit hooks such as randomly constructed mass of entwined conductive yarn or other cloth, paper, rubber or other electroconductive substrate.
8. A means of conducting electrophysiological energy as in Claim 1 wherein the removable patch is secured not only by friction fit Velcro hooks but also, or alternatively, by poppers, buttons, string or other attachment means.
9. A means of conducting electrophysiological energy as in Claim 1 wherein the electrically conductive removable patch is elastic and able to conform to the movement of the human or



INVESTOR IN PEOPLE

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Claims searched: 1-15

10

Examiner: Eamonn Quirk
Date of search: 13 September 2000

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): A5R (RHEC) G1N(NECG, NESS)

Int Cl (Ed.7): A61B (5/00, 5/0408)

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2 291 505 A (Healthcare Technology Limited)	1
A	GB 2 287 882 A (Lowry)	
A	EP 0 013 613 A1 (Johnson & Johnson)	
A	US 4 729 377 (Bio Stimu-Trend)	
A	US 4 709 704 (The Kendall Company)	
X	US 4 391 279 (Clinical Data Inc.) Whole Document	

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.